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SAN ANTONIO METROPOLITAN AREA AIR POLLUTANT EMISSION INVENTORY

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A report is presented of the emission inventory of the San Antonio, Texas Metropolitan Area. The report provides estimates of total emissions of oxides of sulfur, oxides of nitrogen, hydrocarbons, carbon monoxide, and particulate matter. The emissions of these pollutants are delineated with respect to source type, season of the year and geographical distribution within the area. The following sources are included in the report: fuel combustion, transportation, solid waste disposal, industrial process losses, and evaporative losses.

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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
Consumer Protection and Environmental Health Service
National Air Pollution Control Administration
Division of Air Quality and Emission Data
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PREFACE

This report which presents the emissions inventory of the San Antonio Metrpolitan area is another in a series of studies outlining the sources and emissions of air pollutants for major metropolitan areas in the country. These reports provide estimates of total emissions of oxides of sulfur, oxides of nitrogen, hydrocarbons, carbon monoxide and particulate matter. The emissions of these pollutants are delineated with respect to source type, season of the year as well as their geographical distribution within the area. These surveys are also intended to determine the present level of emissions and status of their control.

The general procedure for these surveys is based on the rapid survey technique.[1] The Study Area is divided into grid zones that serve as the basis for locating sources and reporting their emissions. All sources of pollutants are divided into two subgroups - point and area sources. Sources that emit large quantities of air pollutants are considered individually and located specifically within the area. This latter group which generally contains about fifty to one hundred sources typically includes large industries, power plants, and central refuse burning facilities. The remaining multitude of sources are considered collectively as area sources and their emissions are reported as totals for grid zones. This category includes motor vehicles, home heating, smaller industries, on-site refuse burning etc. The emissions in both cases are expressed in terms of tons of pollutants for an average annual, summer, and winter day.

Emissions for the most part are estimated using various indicators of pollutant emissions and average emission factors that are related to these. This means that information and data are collected on fuel consumption, refuse burning rates, vehicle miles and gasoline consumption, as well as various production data. These are then translated into emission estimates by use of average emission factors.[2] These factors, for the most part, represent average emission rates for a particular industry

or fuel type. Because of the inherent difference in type of equipment, operating rates, control equipment, and efficiency of operation among the plants and fuel users within a given category, the application of the emission factors to any individual plant or even a smaller number of similar plants or processes may result in a discrepancy between the actual and the estimated emissions. However, the estimates of total pollutants from all sources in the study area should be reasonably accurate since the emission factors are based on average conditions.

INTRODUCTION

The information and data presented in this report were gathered in cooperation with the acknowledged state and local agencies during a survey conducted in January 1969. The data obtained in this study is for the most part representative of 1968 and emission estimates presented herein should be considered as showing the conditions during 1968.

For purposes of this survey, a Study Area consisting of eight counties surrounding the city of San Antonio was selected. This entire area covers some 7,300 square miles and included a 1968 population of about 980 thousand people. The Study Area was subdivided into 63 grid zones ranging in size from 25 square kilometers in the heavily populated and industrialized areas to 1,600 square kilometers in the outlying areas.

Any individual source which had emissions of any one pollutant greater than 0.5 ton per average annual day was classified as a point source and located specifically in the aforementioned grid zones. Thirty-five individual sources fall into this classification and the remaining single sources were added to the area sources and reported as grid totals.

SUMMARY OF RESULTS

An estimated 740,000 tons of the five major pollutants are emitted annually in the Study Area. The breakdown of these emissions by type of pollutant and source category are summarized in Table 1. The following is a brief summary of pollutant emissions as presented in Table 1.

Sulfur Oxides

1968 Total = 2,100 Tons

Road Vehicles	85.3%
Other Transportation	11.4%
Utility Power Plants	0.5%
Solid Waste Disposal	2.8%

Particulates

1968 Total = 128,700 Tons

Road Vehicles	2.3%
Other Transportation	3.0%
Fuel Combustion	
Industrial	0.1%
Residential	0.1%
Commercial	0.1%
Utility Power Plants	0.2%
Solid Waste Disposal	1.0%
Industrial Process	93.2%

Carbon Monoxide

1968 Total = 496,300 Tons

Road Vehicles	90.5%
Other Transportation	8.2%
Solid Waste Disposal	1.3%

Hydrocarbons

1968 Total = 71,000 Tons

Road Vehicles	47.9%
Other Transportation	11.7%
Solid Waste Disposal	2.8%
Evaporative Losses	37.6%

Nitrogen Oxides

1968 Total = 39,500 Tons

Road Vehicles	55.9%
Other Transportation	12.7%
Fuel Combustion	
Industrial	3.5%
Residential	2.1%
Commerical	0.9%
Utility Power Plants	21.4%
Solid Waste Disposal	1.6%
Industrial Process	1.9%

TABLE 1

SUMMARY OF AIR POLLUTANT EMISSIONS IN SAN ANTONIO STUDY AREA, 1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Transportation					
Road Vehicles	1,800	3,000	448,900	34,000	22,100
Other	240	3,860	40,800	8,300	5,000
Sub-Total	2,040	6,860	489,700	42,300	27,100
Fuel Combustion in Stationary Sources					
Industry	N	110	N	N	1,400
Steam-Electric Utility	10	320	N	N	8,460
Residential	N	120	N	N	830
Commercial & Institutional	N	60	N	N	370
Sub-Total	10	610	N	N	11,060
Solid-Waste Disposal					
Dumps	40	910	4,800	1,700	600
On-site Open Burning	20	430	1,600	300	30
Sub-Total	60	1,340	6,400	2,000	630
Industrial Processes	--	119,900	200	--	740
Evaporative Losses					
Dry Cleaning	--	--	--	1,960	--
Automobile	--	--	--	19,700	--
Gasoline Storage & Handling	--	--	--	5,000	--
Sub-Total	--	--	--	26,660	--
Total All Sources*	2,110	128,700	496,300	71,000	39,500

N = Negligible

* = Totals have been rounded in some cases.

STUDY AREA

The Study Area for the emission survey of the San Antonio Metropolitan Area consists of eight counties--Atascosa, Bandera, Bexar, Comal, Guadalupe, Kendall, Medina and Wilson. The eight county area is located in the south-central region of Texas. Figure 1 shows the location of the San Antonio Study Area relative to other large cities in its vicinity.

Figure 2 represents a more detailed drawing of the San Antonio Study Area, showing the boundaries of the city of San Antonio. The Study Area occupies 7,320 square miles and contains an estimated 1968 population of 981,600, which is approximately a 23 percent increase since 1960 (Table 2)[3]. The population density map (Figure 3) shows that the heaviest population is concentrated in and near the city of San Antonio.

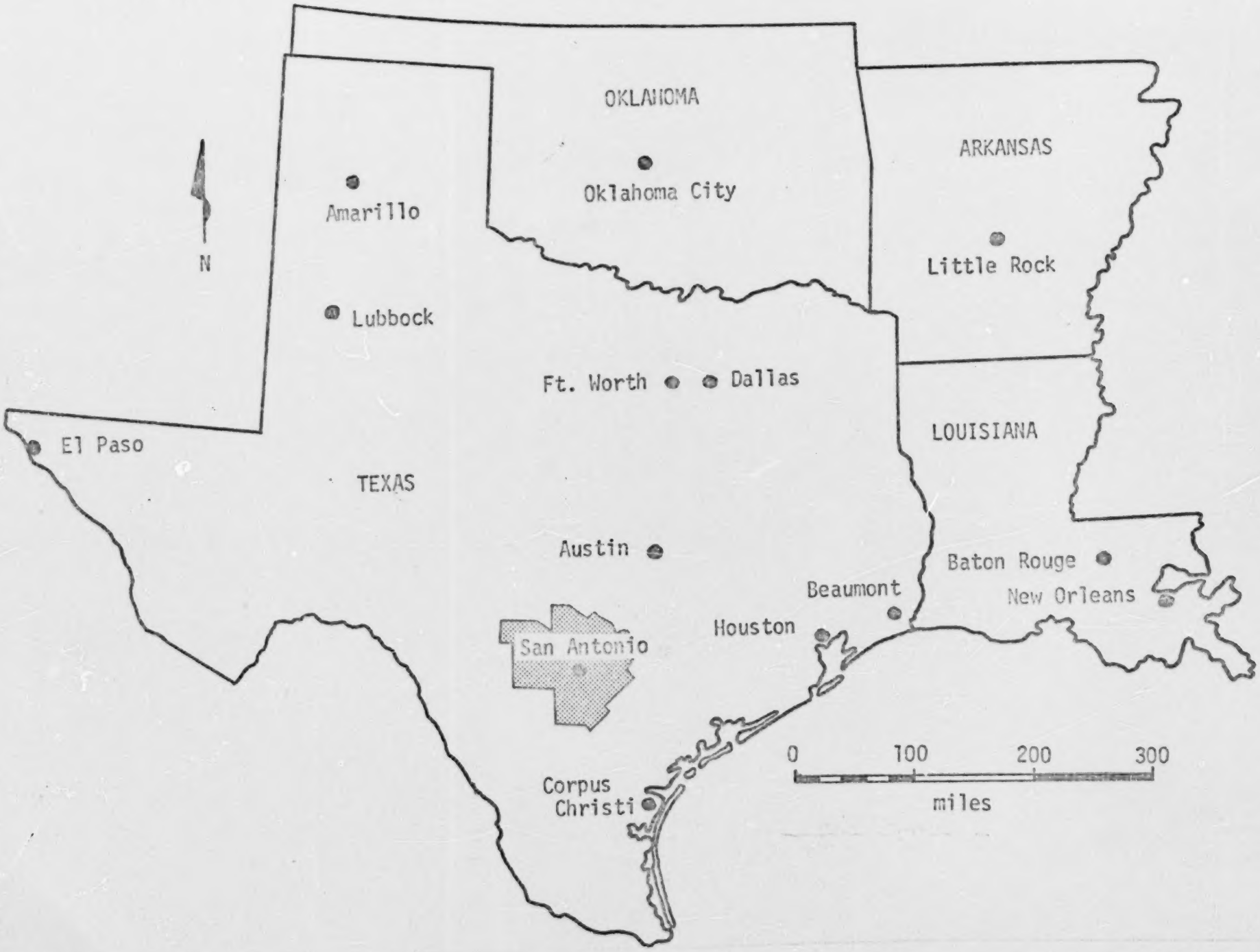

Figure 1 Location of the San Antonio Study Area Within the State of Texas

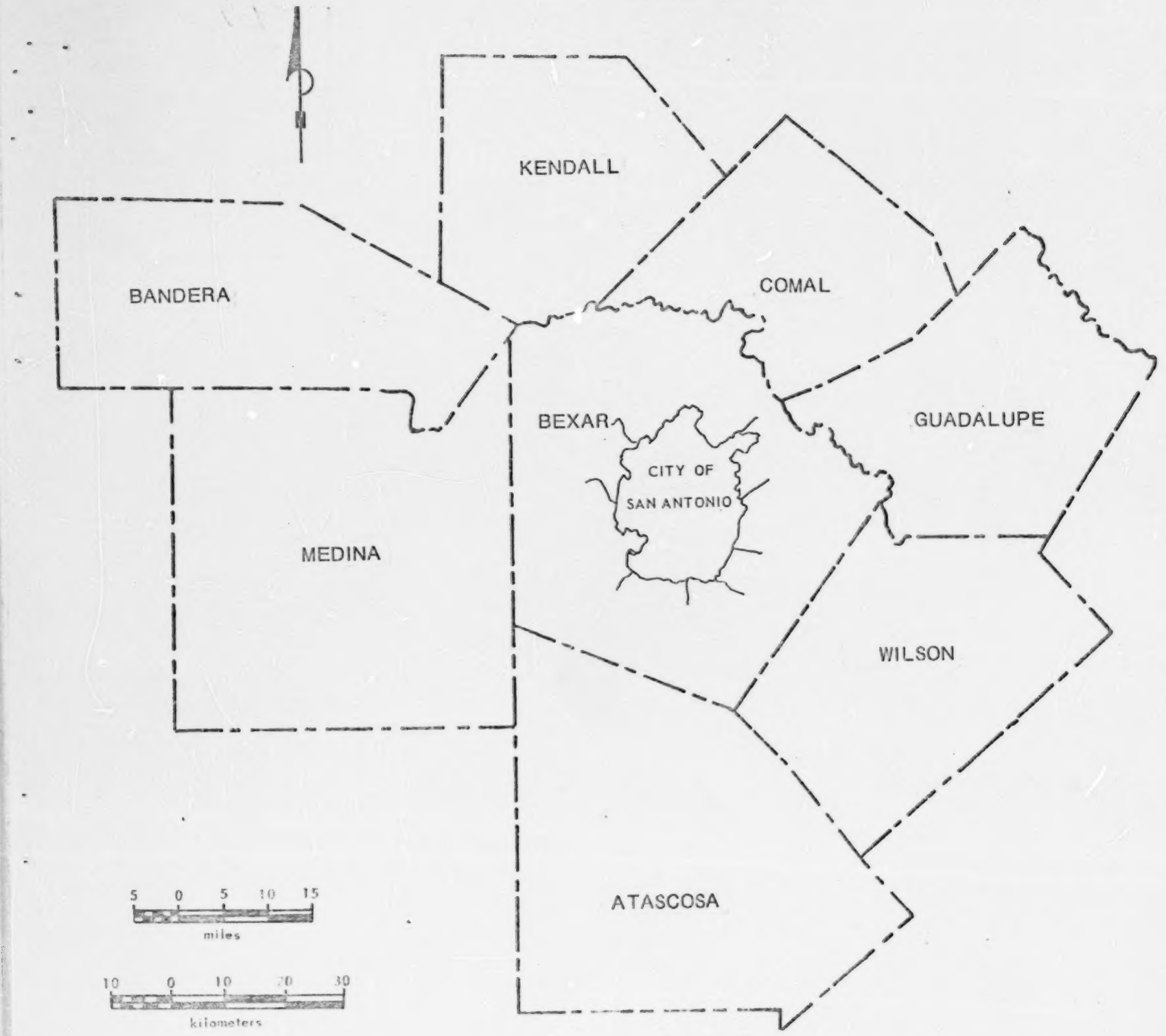

Figure 2. Detailed map of the San Antonio study area.

TABLE 2
AREA AND POPULATION CHARACTERISTICS FOR
SAN ANTONIO STUDY AREA

Political Jurisdiction	Land Area (sq. mi.)	Population 1960	Population 1968	Population Density (1968)
Atascosa County	1,206	18,800	21,200	17
Bandera County	763	3,900	4,400	6
Bexar County	1,246	687,500	861,000	691
Comal County	567	19,800	23,000	40
Gaudalupe County	714	29,000	29,100	41
Kendall County	670	5,600	7,500	11
Medina County	1,352	18,900	21,000	16
Wilson County	802	13,300	14,400	18
Total Study Area	7,320	796,800	981,600	134

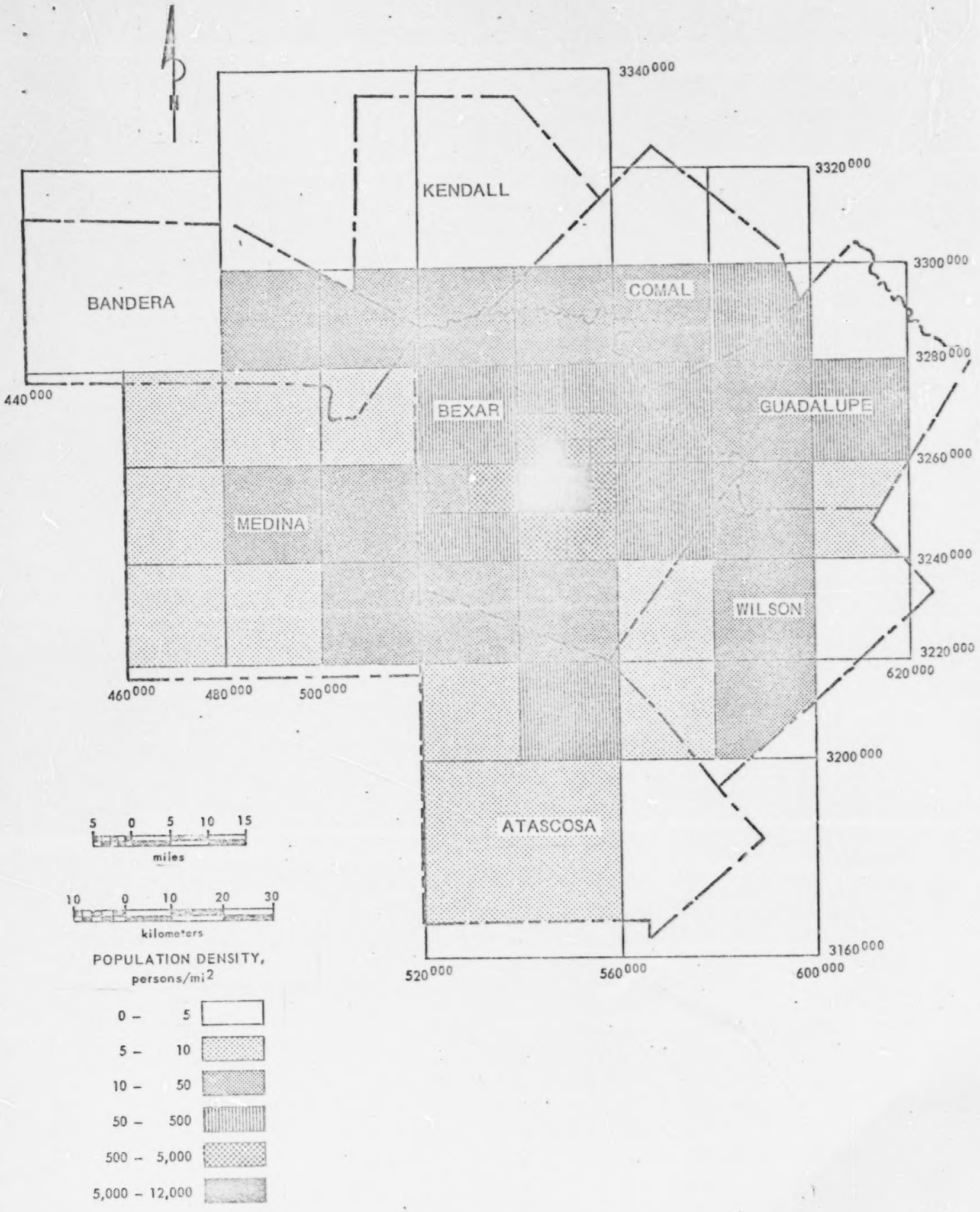

Figure 3. Population density for San Antonio metropolitan area, 1968.

TOPOGRAPHY

The San Antonio Study Area is located in the south-central portion of Texas. The central and south-eastern region of Bexar County lies on the edge of the Gulf Coastal Plain. Thus, in this part of Bexar County as well as most all of Guadalupe and Wilson Counties, the land is level to gently rolling.

The Balcones Fault excarpment enters the northeastern part of Bexar County and swings westward passing just above the city of San Antonio. This section is characterized by rocky, hilly, country along the northern edge of Bexar County, (with rugged hills and low mountains up into Kendall County) to rolling land in Comal County.

The upper third of Medina County, upper one fifth of Bexar County along with the majority of Bandera and Kendall County form the South-eastern tip of the Edwards Plateau. The plateau has a characteristically rough topography

The lower two thirds of Medina County, south-western tip of Bexar County and all of Atascosa County are located in the Rio Grande Plain, in which the land is generally level to rolling prairie.

GRID COORDINATE SYSTEM

Grid coordinates based on the Universal Transverse Mecator System were used in this study to show the geographical distribution of sources and emissions. As shown in Figure 4, the Study Area was divided into 63 grids of four different sizes - 25, 100, 400 and 1,600 square kilometers.

Different size grids are used to limit the number of grid zones and yet allow a satisfactory definition of geographical gradation of emissions in areas where the majority of pollution occurs. For this reason, the 25 square kilometer grids are used in the downtown areas and areas of high industrial concentration where the emission densities would change abruptly within short distances. In areas primarily rural in nature, the use of small zones are not as important.

As illustrated in Figure 4 each grid line is identified by a coordinate number. The north-south and the east-west coordinates are expressed in meters.

The point sources in the Study Area are identified by both horizontal and vertical coordinates to the nearest 100 meters. The grids are identified by the coordinates of their geographical center.

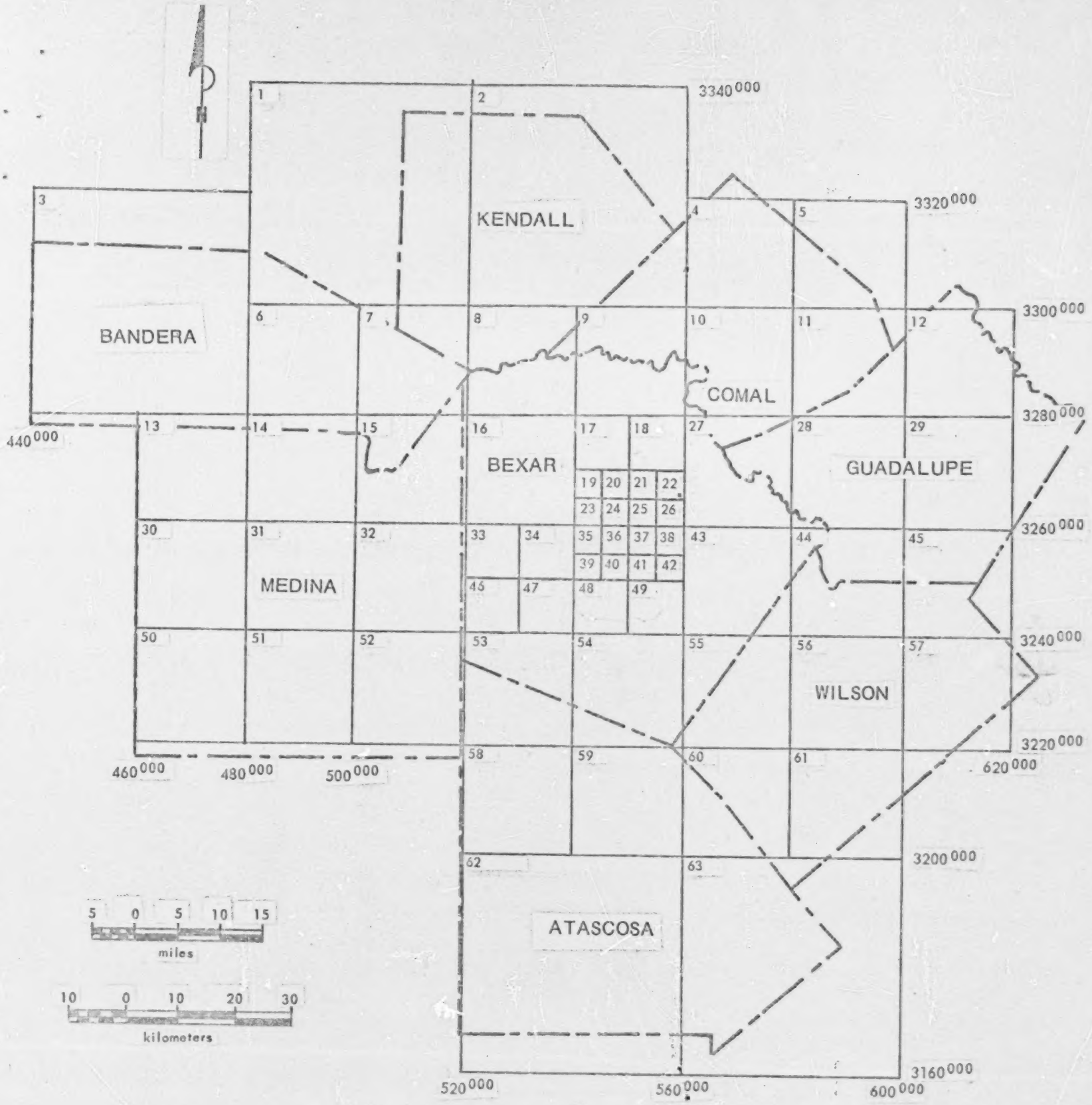

Figure 4. Grid Coordinate System For San Antonio Study Area.

EMISSIONS BY CATEGORY

For the purposes of compiling the basic data and emission estimates, the air pollutant sources were classified into the following five categories:

1. Fuel combustion in stationary sources
2. Transportation
3. Solid Waste disposal
4. Industrial process losses
5. Evaporative losses

Each of these categories are considered individually in this section where data sources are given and methods of calculation are discussed.

It is important to note that the estimates presented herein are, in most cases, partial totals. This stems from the inavailability of emission factors as well as appropriate production data. The results should be viewed with these limitations in mind.

Fuel Combustion in Stationary Sources

Table 3 presents the fuel consumption within the Study Area. As shown in the table, natural gas is the primary fuel used in the area. During 1968, over 77 billion cubic feet of natural gas were consumed within the Study Area.

The steam-electric utility plants are the largest fuel users in the area, consuming over 56 percent of the natural gas. Industries consume approximately 17 percent of the total natural gas, residential units 19 percent and commercial establishments 8 percent.

Natural gas, for all practical purposes, is the only fuel used for residential home heating. There are homes heated by other fuels but they represent a very small percentage of the total.

TABLE 3

NATURAL GAS CONSUMPTION FOR SAN ANTONIO STUDY AREA, 1968

(Million Cubic Feet/Year)

Political Jurisdiction	Industrial	Steam Electric Utility	Residential	Commercial & Institutional	*Total
Atascosa County	14	--	230	60	300
Bandera County	2	--	110	15	130
Bexar County	12,500	37,500	12,700	6,100	68,800
Comal County	417	5,900	340	120	6,780
Gaudalupe County	55	--	370	145	570
Kendall County	--	--	180	12	190
Medina County	90	--	280	50	420
Wilson County	2	--	160	28	190
Total Study Area*	13,100	43,400	14,400	6,500	77,400

* Totals have been rounded

Emissions from Fuel Combustion

Air pollutant emissions resulting from fuel combustion in stationary sources are summarized in Table 4. The emissions are presented for industrial, steam-electric utility, residential and commercial--institutional sources. Emissions from natural gas consumption account for approximately 28 percent of the total nitrogen oxide emissions and less than 1 percent of the total for any other pollutant.

Data Sources

Natural gas numbers were supplied by the local air pollution agencies which had obtained these numbers by jurisdiction with a breakdown by industry, residential, commercial and institutional source categories. The fifteen largest industrial users in Bexar County, as well as all steam-electric plants were considered individually as single sources. The balance of the fuel was distributed to the three area source categories of fuel consumption: (1) residential (2) commercial--institutional and (3) industrial.

The amount of fuel burned for home heating purposes was calculated using the procedure described in the Rapid Survey Technique.[4] This method involves the use of such variables, as total annual degree days, average number of rooms per dwelling unit, and the number of units using each type of fuel.

TABLE 4

AIR POLLUTANT EMISSIONS FROM FUEL COMBUSTION SOURCES IN SAN ANTONIO STUDY AREA, 1968 (TONS/YEAR)

Fuel	User Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Gas	Industrial	N	110	N	N	1,400
	Steam-electric	10	320	N	N	8,460
	Residential	N	120	N	N	830
	Commercial & Institutional	N	60	N	N	370
	Totals	10	610	N	N	11,060

N = Negligible

Transportation

Three types of transportation sources of air pollution are considered in this survey--road vehicles, aircraft, and railroads. Road vehicles, which are by far the most significant source of air pollution in this category, are further subdivided according to type of fuel--gasoline or diesel.

Road Vehicles

The miles of travel by motor vehicles in the Study Area are summarized in Table 5. Vehicle mile data for all major arterials and highways in Bexar County were obtained from a transportation study performed by the San Antonio Bexar County Urban Transportation Study for 1968. Estimates were made by local highway department officials in order to include the traffic on secondary and rural roads in Bexar County. The vehicle miles were apportioned onto grids by traffic flow maps provided by the local air pollution officials.

In the other seven counties, vehicle mile information was not available and thus gasoline consumption[5] was used to find vehicular emissions. The gasoline consumed in each county was apportioned on a grid basis by population.

Emissions from diesel powered vehicles were determined by diesel fuel consumption in each county.[6] These emissions were apportioned on a grid basis by assuming they were proportional to gasoline emissions.

Emissions from road vehicles are a function of the speed at which the vehicle travels. Average speeds of 10-20 mph were assumed for downtown areas; 20-30 mph for the residential areas; and 30-45 mph for the rural areas.

From all transportation sources, road vehicles accounted for 88 percent of the sulfur oxides, 44 percent of the particulates, 92 percent of the carbon monoxide, 87 percent of the hydrocarbons and 81 percent of the nitrogen oxides. Gasoline powered road vehicles contributed a greater percent of all pollutants than diesel powered road vehicles. Emissions from transportation sources are summarized in Table 6.

TABLE 5

VEHICLE MILES OF TRAVEL FOR ROAD VEHICLES IN SAN ANTONIO STUDY AREA, 1968 (PER DAY)

Political Jurisdiction	Vehicle Miles x 1,000
Atascosa County	280
Bandera County	100
Bexar County	11,300
Comal County	400
Gaudalupe County	470
Kendall County	140
Medina County	310
Wilson County	200
Total Study Area	13,200

TABLE 6

AIR POLLUTANT EMISSIONS FROM TRANSPORTATION SOURCES
IN SAN ANTONIO STUDY AREA, 1968 (Tons/Year)

Sources	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Road Vehicles					
Gasoline	1,400	1,900	448,300	32,700	19,900
Evaporation	--	--	--	19,700	--
Diesel	400	1,100	600	1,350	2,200
Sub-Total	1,800	3,000	448,900	53,750	22,100
Aircraft					
Jet	N	3,040	2,600	900	2,000
Piston	N	160	37,800	6,580	1,650
Turboprop	N	N	10	N	N
Sub-Total	N	3,200	40,400	7,480	3,650
Railroads	240	660	360	820	1,330
Total All Sources*	2,040	6,860	489,700	62,000	27,100

N = Negligible

* = Totals Have Been Rounded in Some Cases

Aircraft

Table 7 shows the air traffic activity at the four largest airports in the Study Area. Data from the two air forces bases was obtained from officials at each base. The local air pollution agency contacted the other two major airports in the Area in order to obtain their flight data for 1968. The breakdown of all flights at each airport by engine type is shown in Table 8. From all transportation sources aircraft accounted for 47 percent of the particulates 8 percent of the carbon monoxide, 12 percent of the hydrocarbons and 13 percent of the nitrogen oxides.

Railroads

Railroads consume about 12 million gallons of diesel fuel per year in the Study Area. These figures were obtained from the various railroads in the Study Area. The air pollutant emissions arising from railroad sources are insignificant when compared to other transportation sources.

Solid Waste Disposal

Approximately 1.1 million tons of refuse were generated during 1968 in the Study Area. Table 9 presents a solid waste balance for the San Antonio Study Area, showing the various methods of disposal and the quantities disposed of by each method.

Landfills accounted for 78 percent of the total refuse disposed, open burning dumps 10 percent, on-site open burning 5 percent and on-site dumping 7 percent.

Refuse data for Bexar County was supplied by the San Antonio Air Pollution Control Agency. For all adjacent counties, the data source was the Texas State Air Pollution Agency.

Table 10 shows the air pollutant emissions from solid waste disposal in the San Antonio Study Area. A total of 6,400 tons of carbon monoxide,

1,300 tons of particulates, 2,000 tons of hydrocarbons and 600 of nitrogen oxides were emitted from solid waste disposal practices. The largest sources were five open burning dumps in Bexar County and single dumps in Atascosa, Guadalupe and Medina Counties.

Industrial Process Losses

Table 11 shows selected manufacturing establishments in the area by county for 1963.[7] It may be noted from the table that Bexar County accounts for the largest single percentage of every type of manufacturing. At least seventy percent of the establishments of any type are located in Bexar County.

Emissions from industrial process losses are shown in Table 12.

Particulate emissions from the mineral products industry are the only significant source of air pollution from this category. Industrial porcess losses account for over 93 percent of the total particulate emissions in the Study Area.

Evaporative Losses

Three source categories are considered for evaporative losses--solvent evaporation from dry cleaning plants, gasoline storage and handling losses, and evaporative losses from automobiles.

Organic solvents emitted from dry cleaning plants were determined by assuming an emission rate of approximately 4 lb/yr./capita.[3] The resulting emissions were apportioned onto grids by population.

Automobile evaporative losses were calculated from vehicle mile data and the emissions apportioned onto grids using the same methods as for road vehicles.

The sources of emissions for gasoline storage and handling losses were limited to six sites within Bexar County. The six terminals were located in their respective grids and the resulting emission calculated.

Evaporative losses from automobiles accounted for approximately 74 percent of the total hydrocarbon emissions, dry cleaning plants 7 percent and gasoline storage and handling 19 percent (See Table 13).

TABLE 7 AIR TRAFFIC ACTIVITY AT SAN ANTONIO INTERNATIONAL, STINSON FIELD, AND TWO MAJOR AIR FORCE BASES FOR 1968

Type Operation	San Antonio International		Stinson Field		A. F. B.	A. F. B.
	Itinerate Flights	Local Flight	Itinerate Flights	Local Llights	Total Flights	Total Flights
Air Carrier	32,280	--	--	--	--	--
General Aviation	66,350	38,170	17,170	35,420	--	--
Military	2,260	2,700	170	40,780	163,000	179,000
TOTALS	100,890	40,870	17,340	76,200	163,000	179,000

TABLE 8 AIR TRAFFIC ACTIVITY AT MAJOR AIRPORTS BY ENGINE-TYPE FOR 1968

Engine Type	San Antonio International	Stinson Field	A. F. B.	A. F. B.
1 Engine Piston	74,330	31,420	---	---
2 Engine Piston	30,430	31,420	16,300	35,800
4 Engine Poston	---	---	40,750	---
2 Engine Fan-Jet	5,660	---	---	---
3 Engine Fan-Jet	10,310	---	---	---
4 Engine Fan-Jet	2,230	---	---	---
1 Engine Conv. Jet	---	---	32,600	---
2 Engine Conv. Jet	7,460	14,330	24,450	89,500
3 Engine Conv. Jet	1,240	12,280	---	53,700
4 Engine Conv. Jet	7,910	4,090	40,750	---
4 Engine Turboprop	2,190	---	---	---
Total All Flights	141,760	93,540	163,000	179,000

Conv. = Conventional

TABLE 9

SOLID WASTE BALANCE FOR SAN ANTONIO STUDY AREA

1968 (TONS/YEAR)

Political Jurisdiction	Total Refuse Generated	Landfills	Burning Dumps	On-Site Disposal Open Burning	Dumps
Atascosa County	19,300	--	12,300	2,800	4,200
Bandera County	4,000	--	1,000	1,200	1,800
Bexar County	996,400	865,200	57,600	29,400	44,200
Comal County	20,900	4,200	5,500	4,500	6,700
Gaudalupe County	26,500	--	19,000	3,000	4,500
Kendall County	6,800	--	3,000	1,500	2,300
Medina County	19,100	--	11,200	3,200	4,700
Wilson County	13,100	--	4,300	3,500	5,300
Total Study Area	1,106,100	869,400	113,900	49,100	73,700

TABLE 10

AIR POLLUTANT EMISSIONS FROM SOLID WASTE DISPOSAL IN SANTONIO STUDY AREA, 1968

(TONS/YEAR)

Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Open Burning					
On-site	15	425	1,595	310	30
Dumps	40	915	4,810	1,750	595
Totals	55	1,340	6,405	2,015	625

TABLE 11

SELECTED MANUFACTURING ESTABLISHMENTS IN

SAN ANTONIO STUDY AREA 1963

Establishments by Jurisdiction	TYPE ESTABLISHMENT						
	Food & Kindred Products	Textile Products	Paper & Printing	Chemicals & Petroleum Products	Stone, Clay & Glass	Metal Products	Total
Atascosa	--	--	--	--	--	--	--
Bandera	--	1	--	--	--	--	1
Bexar	62	25	24	10	16	15	152
Comal	1	3	--	--	2	--	6
Guadalupe	4	1	--	--	1	1	7
Kendall	--	--	--	--	--	--	--
Medina	--	--	--	--	2	--	2
Wilson	--	--	--	--	1	--	1
Total Study Area	67	30	24	10	22	16	169

TABLE 12

AIR POLLUTANT EMISSIONS FROM PROCESS LOSS SOURCES IN THE SAN ANTONIO STUDY AREA, 1968 (TONS/YEAR)

Type of Industry	SO_x	Part.	CO	HC	NO_x
Cement Plants	--	65,200	--	--	740
Lime Manufacturing	--	1,350	--	--	--
Concrete Plants	--	60	--	--	--
Rock Processing	--	36,400	--	--	--
Asphalt Plants	--	480	--	--	--
Foundries	--	10	200	--	--
Vermiculite Plants	--	400	--	--	--
Structural Materials	--	500	--	--	--
TOTALS	--	114,400	200	--	740

TABLE 13

HYDROCARBON EMISSIONS FROM EVAPORATIVE LOSSES SOURCES IN SAN ANTONIO STUDY AREA, 1968 (TONS/YEAR)

Source Category	Hydrocarbons
Dry cleaning Plants	1,960
Automobile	19,700
Gasoline Storage & Handling	5,000
Total	26,660

EMISSIONS BY JURISDICTION

In order to determine which counties are significant from an air pollution standpoint, emissions have been summarized for each of the eight counties. Table 14 through Table 21 present the summary of emissions for each county.

The air pollutant emissions are far greater in Bexar County than in any of the other seven counties. Since Bexar County is more heavily populated and contains the majority of all industry in the Area, this seems reasonable. Bexar County accounts for 88 percent of the total sulfur oxides in the Study Area, 94 percent of the particulates, 88 percent of the carbon monoxide, 88 percent of the hydrocarbons, and 87 percent of the nitrogen oxides.

TABLE 14 SUMMARY OF AIR POLLUTANT EMISSIONS IN ATASCOSA COUNTY, 1968 (TONS YEAR)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Road Vehicles	40	70	8,900	700	500
Other	--	--	--	--	--
Sub-Total	40	70	8,900	700	500
Fuel Combustion in Stationary Sources					
Industrial	N	N	N	N	N
Steam-Electric	--	--	--	--	--
Residential	N	N	N	N	10
Commercial & Institutional	N	N	N	N	N
Sub-Total	N	N	N	N	10
Solid Waste Disposal					
Dumps	10	100	520	190	70
On-Site Open Burning	N	20	90	20	N
Sub-Total	10	120	610	210	70
Industrial Processes	NA	NA	NA	NA	NA
Evaporative Losses					
Dry cleaning	--	--	--	40	--
Automobile	--	--	--	450	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	490	--
TOTAL ALL SOURCES	50	190	9,510	1,400	580

N = Negligible

NA = Information not available or not reported

TABLE 15 SUMMARY OF AIR POLLUTANT EMISSIONS IN BANDERA COUNTY, 1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Transportation					
Road Vehicles	10	20	2,900	220	160
Other	--	--	--	--	--
Sub-Total	10	20	2,900	220	160
Fuel Combustion in Stationary Sources					
Industrial	N	N	N	N	N
Steam-Electric Utility	--	--	--	--	--
Residential	N	N	N	N	N
Commercial and Institutional	N	N	N	N	N
Sub-Total	N	N	N	N	N
Solid Waste Disposal					
Dumps	N	10	40	20	N
On-site Open Burning	N	10	40	10	N
Sub-Total	N	20	80	30	N
Industrial Processes	NA	NA	NA	NA	NA
Evaporative Losses					
Dry cleaning	--	--	--	20	--
Automobile	--	--	--	140	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	160	--
TOTAL ALL SOURCES	10	40	2,980	410	160

N = Negligible

NA = Information not available or not reported

TABLE 16

SUMMARY OF AIR POLLUTANT EMISSIONS IN BEXAR COUNTY
1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Transportation					
Road vehicles	1,560	2,560	394,800	29,800	19,100
Other	240	3,860	40,800	8,300	5,000
Sub-Total	1,800	6,420	435,600	38,100	24,100
Fuel Combustion in Stationary Sources					
Industrial	N	110	N	N	1,340
Steam-Electric Utility	10	280	N	N	7,310
Residential	N	120	N	N	740
Commercial & Institutional	N	60	N	N	350
Sub-Total	10	570	N	N	9,740
Solid-Waste Disposal					
Dumps	30	460	2,440	860	320
On-site Open Burning	20	250	960	180	30
Sub-Total	50	710	3,400	1,040	350
Industrial Processes	--	114,400	200	--	740
Evaporative Losses					
Dry Cleaning	--	--	--	1,700	--
Automobile	--	--	--	17,000	--
Gasoline Storage & Handling	--	--	--	5,000	--
Sub-Total	--	--	--	23,700	--
Total All Sources *	1,860	121,400	439,200	62,800	34,600

N = Negligible

* = Totals Have Been Rounded in Some Cases.

TABLE 17

SUMMARY OF AIR POLLUTANT EMISSIONS IN COMAL COUNTY

1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Transportation					
Road Vehicles	50	80	11,500	900	650
Other	--	--	--	--	--
Sub-Total	50	80	11,500	900	650
Fuel Combustion in Stationary Sources					
Industrial	N	N	N	N	40
Steam-Electric Utility	N	40	N	N	1,150
Residential	N	N	N	N	20
Commerical & Institutional	N	N	N	N	10
Sub-Total	N	40	N	N	1,220
Solid-Waste Disposal					
Dumps	N	40	230	80	30
On-site Open Burning	N	40	150	30	N
Sub-Total	N	80	380	110	30
Industrial Processes	--	5,000	--	--	--
Evaporative Losses					
Dry Cleaning	--	--	--	50	--
Automotive	--	--	--	580	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	630	--
Total All Sources	50	5,120	11,900	1,640	1,900

N = Negligible

NA = Information Not Available or not reported

TABLE 18 SUMMARY OF AIR POLLUTANT EMISSIONS IN GUADULUPE COUNTY, 1968 (TONS/YEAR)

Source Catetory	Sulfur Oxides	Partic-ulates	Carbon Monoxides	Hydro-carbons	Nitrogen Oxides
Transportation					
Road Vehicles	60	100	13,800	1,100	780
Other	--	--	--	--	--
Sub-Total	60	100	13,800	1,100	780
Fuel Combustion in Stationary Sources					
Industrial	N	N	N	N	10
Steam-Electric Utility	--	--	--	--	--
Residential	N	N	N	N	20
Commercial & Institutional	N	N	N	N	10
Sub-Total	N	N	N	N	40
Solid Waste Disposal					
Dumps	10	150	800	290	100
On-Site Open Burning	N	30	100	20	N
Sub-Total	10	180	900	310	100
Industrial Processes	--	500	--	--	--
Evaporative Losses					
Dry cleaning	--	--	--	60	--
Automobile	--	--	--	700	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	760	--
TOTAL ALL SOURCES	70	780	14,700	2,170	920

N = Negligible

NA = Information not available or not reported

TABLE 19

SUMMARY OF AIR POLLUTANT EMISSIONS IN KENDALL COUNTY

1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Road Vehicles	10	20	2,450	190	140
Other	--	--	--	--	--
Sub-Total	10	20	2,450	190	140
Fuel Combustion in Stationary Sources					
Industrial	--	--	--	--	--
Steam-Electric Utility	--	--	--	--	--
Residential	N	N	N	N	10
Commercial & Institutional	N	N	N	N	N
Sub-Total	N	N	N	N	10
Solid Waste Disposal					
Dumps	N	20	120	40	100
On-site Open Burning	N	10	50	10	N
Sub-Total	N	30	170	50	100
Industrial Processes	NA	NA	NA	NA	NA
Evaporative Losses					
Dry Cleaning	--	--	--	20	--
Automobile	--	--	--	120	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	140	--
Total All Sources	10	50	2,620	280	250

N = Negligible

NA = Information Not Available or Not Reported.

TABLE 20

SUMMARY OF AIR POLLUTANT EMISSIONS IN MEDINA COUNTY

1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Partic-ulates	Carbon Monoxide	Hydro-carbons	Nitrogen Oxides
Transportation					
Road Vehicles	40	60	8,670	680	490
Other	--	--	--	--	--
Sub-Total	40	60	8,670	680	490
Fuel Combustion in Stationary Sources					
Industrial	N	N	N	N	10
Steam-Electric Utility	--	--	--	--	--
Residential	N	N	N	N	20
Commercial & Institutional	N	N	N	N	N
Sub-Total	N	N	N	N	30
Solid Waste Disposal					
Dumps	N	90	470	170	60
On-site Open Burning	N	30	100	20	N
Sub-Total	N	120	570	190	60
Industrial Processes	NA	NA	NA	NA	NA
Evaporative Losses					
Dry Cleaning	--	--	--	40	--
Automobile	--	--	--	430	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	470	--
Total All Sources	40	180	9,240	1,340	580

N = Neglibible

NA = Information Not Available or Not Reported.

TABLE 21

SUMMARY OF AIR POLLUTANT EMISSIONS IN WILSON COUNTY
1968 (TONS/YEAR)

Source Category	Sulfur Oxides	Particulates	Carbon Monoxide	Hydrocarbons	Nitrogen Oxides
Transportation					
Road Vehicles	30	40	5,860	460	330
Other	--	--	--	--	--
Sub-Total	30	40	5,860	460	330
Fuel Combustion in Stationary Sources					
Industrial	N	N	N	N	N
Steam-Electric Utility	--	--	--	--	--
Residential	N	N	N	N	10
Commercial and Institutional	N	N	N	N	N
Sub-Total	N	N	N	N	10
Solid Waste Disposal					
Dumps	N	30	180	60	20
On-site Open Burning	N	30	110	20	N
Sub-Total	N	60	290	80	20
Industrial Processes	NA	NA	NA	NA	NA
Evaporative Losses					
Dry Cleaning	--	--	--	30	--
Automobile	--	--	--	290	--
Gasoline Storage & Handling	--	--	--	NA	--
Sub-Total	--	--	--	320	--
Total All Sources	30	100	6,150	860	360

N = Negligible

NA = Information Not Available or Not Reported

EMISSIONS BY GRID

For the purpose of modeling the air pollutant emissions in the Study Area, the resulting emissions were apportioned on the grid reference system shown in Figure 4.

The emissions of each pollutant were divided into two source subgroups--point and ares sources. The 35 point sources were identified by source category, grid number and horizontal and vertical coordinates. Figure 5 shows the location of all major point source in the Study Area. The point sources are presented in Table 22, along with emissions of particulates, carbon monoxide, hydrocarbons and nitrogen oxides for an average annual, winter and summer day. Sulfur oxides were not included in this table because the emissions are negligible for each point source. The appendix presents the method of calculating these three averages.

The emissions from all sources on the annual, winter and summer basis are shown in Table 23. The calculation of these averages is similar to that presented in the appendix for point sources.

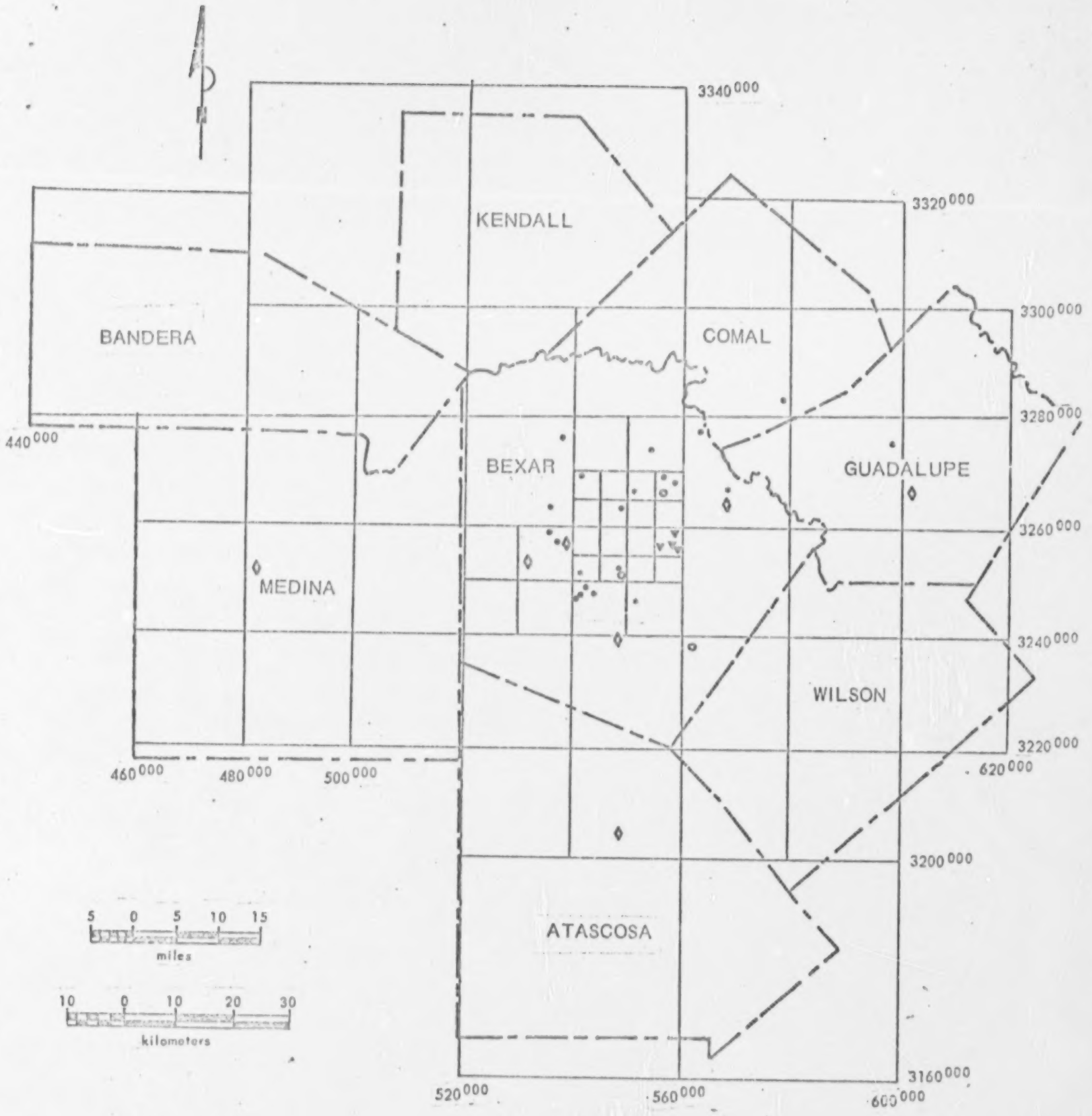

Figure 5. Point Source Locations Within San Antonio Study Area.

TABLE 22 SUMMARY OF AIR POLLUTANT EMISSIONS FROM POINT SOURCES BY SEASON FRO SAN ANTONIO STUDY AREA, 1968 (TONS/DAY)

Source Category	Grid	HC	VC	PART. S	PART. W	PART. A	CO S	CO W	CO A	HC S	HC W	HC A	NO_x S	NO_x W	NO_x A
Gasoline S & H**	38	5585	32561	---	---	---	---	---	---	2.8	2.8	2.8	---	---	---
Gasoline S & H**	38	5551	32569	---	---	---	---	---	---	1.3	1.3	1.3	---	---	---
Gasoline S & H**	38	5575	32591	---	---	---	---	---	---	7.8	7.8	7.8	---	---	---
Gasoline S & H**	38	5579	32562	---	---	---	---	---	---	1.1	1.1	1.1	---	---	---
Airport	39	5410	-32505	3.0	3.0	3.0	52.6	52.6	52.6	10.0	10.0	10.0	4.3	4.3	4.3
S. E. Utility*	40	5406	32520	0.1	0.1	0.1	---	---	---	---	---	---	3.2	1.3	1.5
Industrial	40	5493	32529	1.1	1.1	1.1	---	---	---	---	---	---	---	----	---
S. E. Utility*	48	5412	32468	0.1	0.1	0.1	---	---	---	---	---	---	3.5	2.2	1.9
Industrial	48	5427	32488	0.6	0.6	0.6	---	---	---	---	---	---	---	---	---
Industrial	48	5446	32468	---	---	---	0.5	0.5	0.5	---	---	---	---	---	---
Dump	48	5404	32467	0.1	0.1	0.1	0.5	0.5	0.5	0.2	0.2	0.2	0.1	0.1	0.1
Airport	49	5512	32452	1.0	1.0	1.0	17.6	17.6	17.6	3.0	3.0	3.0	1.3	1.3	1.3
Dump	54	5490	32394	0.2	0.2	0.2	1.2	1.2	1.2	0.4	0.4	0.4	0.2	0.2	0.2
S. E. Utility*	55	5605	32381	0.6	0.4	0.4	---	---	---	---	---	---	16.1	11.4	9.0
Dump	59	5496	32025	0.1	0.1	0.1	0.8	0.8	0.8	0.3	0.3	0.3	0.1	0.1	0.1

**Gasoline Storage & Handling
*Steam Electric Utility

TABLE 23 SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR SAN ANTONIO STUDY AREA
1968 (TONS/DAY)

Grid	Land Area sq. mi.	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A	HC S	HC W	HC A	NO_x S	NO_x W	NO_x A
1	617.7	---	---	---	---	---	---	1.8	1.5	1.7	0.2	0.2	0.2	0.1	0.1	0.1
2	617.6	---	---	---	0.1	0.1	0.1	1.4	1.3	1.3	0.3	0.3	0.3	0.1	0.1	0.1
3	617.6	---	---	---	---	---	---	2.1	1.9	2.0	0.3	0.3	0.3	0.1	0.1	0.1
4	154.4	---	---	---	---	---	---	0.5	0.5	0.5	0.1	0.1	0.1	---	---	---
5	154.4	---	---	---	---	---	---	0.4	0.4	0.4	---	---	---	---	---	---
6	154.4	---	---	---	---	---	---	4.1	3.6	3.9	0.5	0.5	0.5	0.2	0.2	0.2
7	154.4	---	---	---	0.1	0.1	0.1	3.2	2.8	3.0	0.5	0.4	0.4	0.2	0.1	0.2
8	154.4	---	---	---	0.1	0.1	0.1	7.4	6.5	6.9	1.0	0.9	1.0	0.5	0.4	0.4
9	154.4	---	---	---	---	---	---	1.8	1.6	1.7	0.2	0.2	0.2	0.1	0.1	0.1
10	154.4	---	---	---	13.7	13.7	13.7	3.5	3.0	3.3	0.5	0.4	0.4	0.2	0.2	0.2
11	154.4	0.1	0.1	0.1	0.4	0.4	0.4	30.9	26.9	28.9	4.2	3.7	4.0	1.8	1.7	1.7
12	154.4	---	---	---	---	---	---	1.0	0.9	0.9	0.2	0.2	0.2	0.1	0.1	0.1
13	154.4	---	---	---	---	---	---	1.2	1.0	1.1	0.2	0.1	0.1	0.1	0.1	0.1
14	154.4	---	---	---	---	---	---	1.2	1.0	1.1	0.2	0.1	0.1	0.1	0.1	0.1
15	154.4	---	---	---	---	---	---	1.2	1.0	1.1	0.2	0.1	0.1	0.1	0.1	0.1
16	154.4	0.1	0.1	0.1	56.5	56.5	56.5	30.4	26.4	28.4	3.9	3.4	3.7	1.8	1.7	1.7
17	38.6	---	---	---	0.1	0.1	0.1	2.2	1.9	2.0	0.4	0.4	0.4	0.3	0.3	0.3
18	38.6	---	---	---	10.2	10.2	10.2	4.5	4.0	4.3	0.7	0.6	0.7	0.4	0.4	0.4
19	9.6	0.1	0.1	0.1	14.4	14.4	14.4	6.2	5.4	5.8	1.0	0.9	1.0	0.6	0.6	0.6

TABLE 23 SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR SAN ANTONIO STUDY AREA
1968 (TONS/DAY)

Grid	Land Area sq. mi.	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A	HC S	HC W	HC A	NO_x S	NO_x W	NO_x A
20	9.6	0.2	0.2	0.2	0.4	0.4	0.4	35.9	31.2	33.5	4.9	4.3	4.6	2.2	2.1	2.1
21	9.6	0.1	0.1	0.1	1.5	1.4	1.3	41.7	39.5	40.6	6.3	6.5	6.7	14.3	10.6	9.3
22	9.6	0.1	0.1	0.1	178.4	178.4	178.4	10.9	9.5	10.2	1.8	1.6	1.7	2.0	2.4	2.2
23	9.6	0.2	0.2	0.2	0.5	0.5	0.5	40.9	35.6	38.3	6.1	5.4	5.7	2.9	3.2	3.0
24	9.6	0.3	0.3	0.3	1.3	1.3	1.3	75.8	65.9	70.8	9.4	8.2	8.8	4.8	5.1	4.9
25	9.6	0.2	0.2	0.2	0.4	0.4	0.4	41.8	36.3	39.1	5.3	4.6	5.0	2.2	2.6	2.3
26	9.6	0.1	0.1	0.1	0.3	0.3	0.3	27.6	24.0	25.8	3.9	3.4	3.6	1.8	1.7	1.7
27	154.4	0.2	0.2	0.2	8.3	8.3	8.3	52.9	48.2	50.5	8.5	7.8	8.2	5.5	5.4	5.4
28	154.4	---	---	---	1.5	1.5	1.5	7.2	6.3	6.8	1.0	0.9	0.9	0.4	0.4	0.4
29	154.4	0.1	0.1	0.1	0.5	0.5	0.5	26.2	23.1	24.7	3.9	3.5	3.7	1.6	1.5	1.5
30	154.4	---	---	---	---	---	---	1.8	1.6	1.7	0.2	0.2	0.2	0.1	0.1	0.1
31	154.4	---	---	---	0.3	0.3	0.3	8.9	7.9	8.4	1.4	1.3	1.4	0.6	0.6	0.6
32	154.4	---	---	---	0.1	0.1	0.1	4.4	3.9	4.2	0.7	0.6	0.6	0.3	0.2	0.2
33	38.6	---	---	---	---	---	---	2.4	2.1	2.2	0.4	0.3	0.3	0.2	0.2	0.2
34	38.6	0.2	0.2	0.2	7.2	7.2	7.2	42.3	37.1	39.7	5.9	5.2	5.5	2.4	2.3	2.3
35	9.6	0.2	0.2	0.2	0.4	0.4	0.4	50.3	43.7	47.0	6.4	5.6	6.0	2.6	2.6	2.5
36	9.6	0.6	0.5	0.6	1.1	1.5	1.2	192.5	167.3	179.9	20.8	18.2	19.5	7.4	7.4	7.3
37	9.6	0.3	0.3	0.3	0.5	0.6	0.5	87.5	76.0	81.8	9.6	8.4	9.0	3.5	4.8	3.6

TABLE 23 SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR SAN ANTONIO STUDY AREA
1968 (TONS/DAY)

Grid	Land Area (sq. mi.)	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A	HC S	HC W	HC A	NO_x S	NO_x W	NO_x A
38	9.6	0.1	0.1	0.1	0.3	0.3	0.3	28.7	24.9	26.8	16.6	16.1	16.3	1.5	1.4	1.5
39	9.6	0.2	0.2	0.2	3.3	3.4	3.3	84.2	80.0	82.1	14.7	14.2	14.5	6.2	6.4	6.3
40	9.6	0.4	0.4	0.4	2.0	2.0	2.0	127.3	111.1	119.5	14.2	12.4	13.3	8.3	7.7	8.6
41	9.6	0.2	0.2	0.2	0.4	0.5	0.4	67.9	59.0	63.9	7.7	6.7	7.2	2.8	3.3	2.9
42	9.6	0.1	0.1	0.1	0.2	0.2	0.2	14.9	12.9	13.9	2.3	2.1	2.2	1.1	1.1	1.1
43	154.4	0.1	0.1	0.1	0.1	0.1	0.1	12.7	11.0	11.9	1.8	1.5	1.6	0.8	0.8	0.8
44	154.4	---	---	---	---	---	---	2.5	2.2	2.4	0.3	0.3	0.3	0.1	0.1	0.1
45	154.4	---	---	---	---	---	---	1.5	1.3	1.4	0.2	0.2	0.2	0.1	0.1	0.1
46	38.6	---	---	---	---	---	---	1.5	1.3	1.4	0.2	0.2	0.2	0.1	0.1	0.1
47	38.6	0.1	0.1	0.1	0.2	0.2	0.2	12.9	11.2	12.1	1.9	1.7	1.8	0.9	0.9	0.9
48	38.6	0.3	0.3	0.3	1.4	1.4	1.4	73.7	64.2	68.9	9.6	8.3	9.0	7.9	6.6	6.2
49	38.6	0.3	0.3	0.3	1.5	1.5	1.5	86.6	77.6	82.1	11.9	10.7	11.3	5.3	5.1	5.1
50	154.4	---	---	---	---	---	---	1.2	1.0	1.1	0.2	0.2	0.2	0.1	0.1	0.1
51	154.4	---	---	---	---	---	---	1.4	1.2	1.3	0.2	0.2	0.2	0.1	0.1	0.1
52	154.4	---	---	---	0.1	0.1	0.1	6.3	5.5	5.9	0.9	0.8	0.9	0.4	0.4	0.4
53	154.4	---	---	---	0.1	0.1	0.1	9.7	8.5	9.1	1.4	1.2	1.3	0.6	0.6	0.6
54	154.4	---	---	---	0.3	0.3	0.3	9.4	8.4	8.9	1.5	1.3	1.4	0.6	0.6	0.6

TABLE 23 SUMMARY OF AIR POLLUTANT EMISSIONS FROM ALL SOURCES BY SEASON FOR SAN ANTONIO STUDY AREA
1968 (TONS/DAY)

Grid	Land Area (sq. mi.)	SO_x S	SO_x W	SO_x A	PART. S	PART. W	PART. A	CO S	CO W	CO A	HC S	HC W	HC A	NO_x S	NO_x W	NO_x A
55	154.4	---	---	---	0.6	0.4	0.4	4.6	4.0	4.3	0.6	0.5	0.6	16.4	11.6	9.2
56	154.4	---	---	---	0.1	0.1	0.1	8.3	7.2	7.8	1.1	1.0	1.0	0.5	0.4	0.4
57	154.4	---	---	---	---	---	---	1.0	0.9	1.0	0.2	0.1	0.2	---	---	---
58	154.4	---	---	---	---	---	---	2.1	1.8	1.9	0.3	0.2	0.2	0.1	0.1	0.1
59	154.4	0.1	0.1	0.1	0.3	0.3	0.3	15.4	13.6	14.5	2.3	2.1	2.2	1.0	0.9	0.9
60	154.4	---	---	---	---	---	---	0.9	0.8	0.9	0.1	0.1	0.1	---	---	---
61	154.4	---	---	---	0.1	0.1	0.1	3.6	3.2	3.4	0.6	0.5	0.5	0.2	0.2	0.2
62	617.6	---	---	---	0.1	0.1	0.1	7.3	6.4	6.8	1.0	0.9	1.0	0.4	0.4	0.4
63	617.6	---	---	---	---	---	---	1.8	1.6	1.7	0.2	0.2	0.2	0.1	0.1	0.1

EMISSIONS DENSITIES BY GRID

Emissions densities on a grid basis were obtained by summing the annual area and point source emissions for each grid. This total, divided by the grid area, gives an emission density in tons per square mile per average day. Figures 6 through 10 present the emission density maps for the five surveyed pollutants. It is difficult to arrive at any valid conclusions from the emission density maps alone. For this reason, when they are analyzed the detailed map of the Study Area and the population density maps should also be considered.

The emission density maps for carbon monoxide and sulfur oxides show that the greatest emissions occur within the urbanized area of Bexar County. Since transportation sources are the largest single sources of these two pollutants, it would seem logical that in and near the city of San Antonio carbon monoxide and sulfur oxides should be the highest.

The highest particulate densities were in grids 19 and 22. This was due to the location of mineral products plants within these grids which were large point sources. Since approximately 93 percent of the particulate emissions come from industrial process losses, the grids with the highest emissions are, in most cases those in which individual plants are the big sources.

The emission density map for nitrogen oxide shows that the highest densities occur within grids 22, 24, 36, 39, 40. The heavy traffic along with the natural gas consumed by power plants in these areas account for the high densities.

Hydrocarbon emission densities are highest in and around the center city of San Antonio. Again, this is due to the traffic in this area. Hydrocarbon desnities are also high in grid 38 because of the four large gasoline storage and handling operations in this grid.

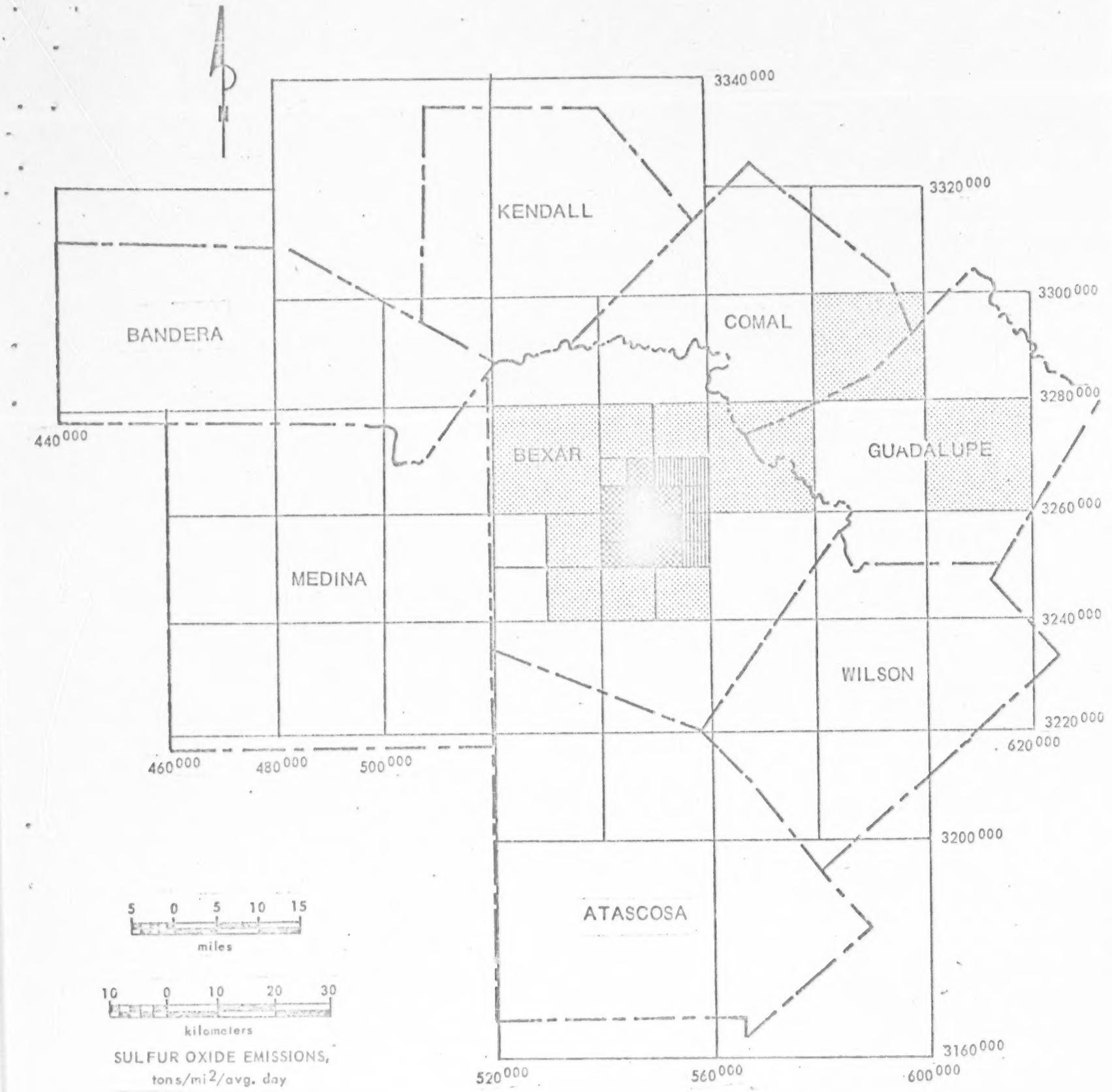

Figure 6. Sulfur oxide emission density map for all sources in San Antonio study area, 1968.

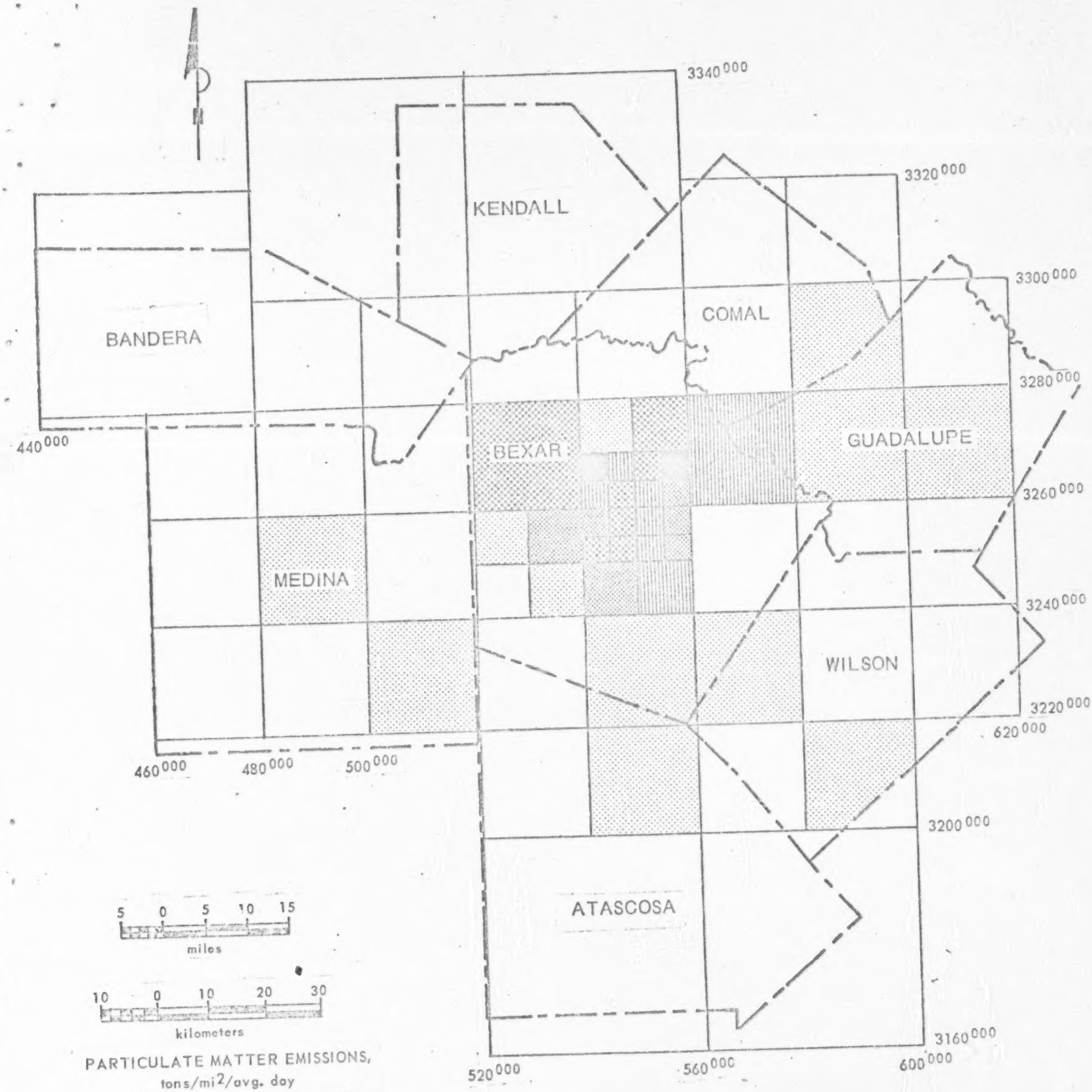

Figure 7. Particulate matter emission density map for all sources in San Antonio study area, 1968.

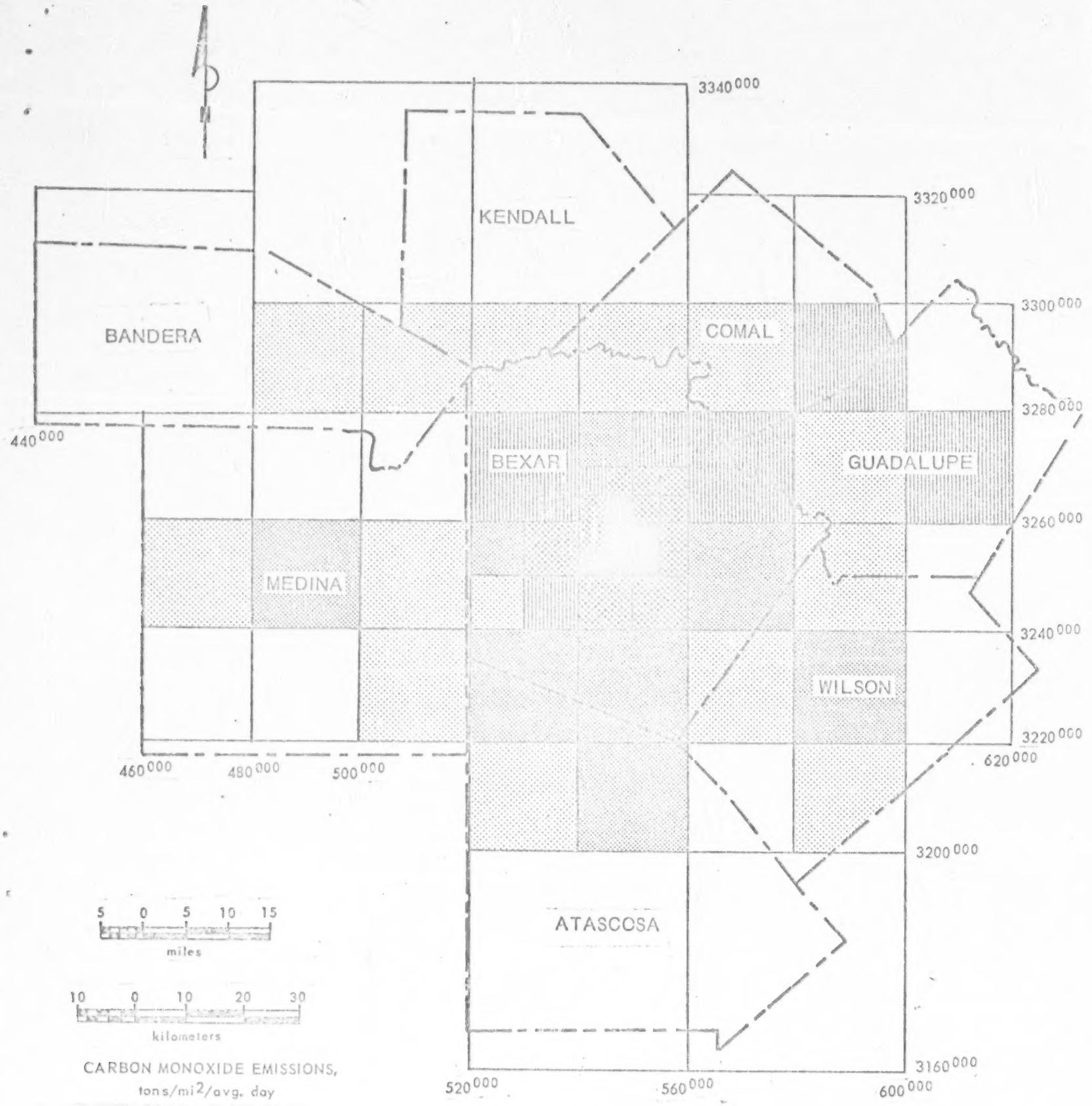

Figure 8. Carbon monoxide emission density map for all sources in San Antonio study area, 1968

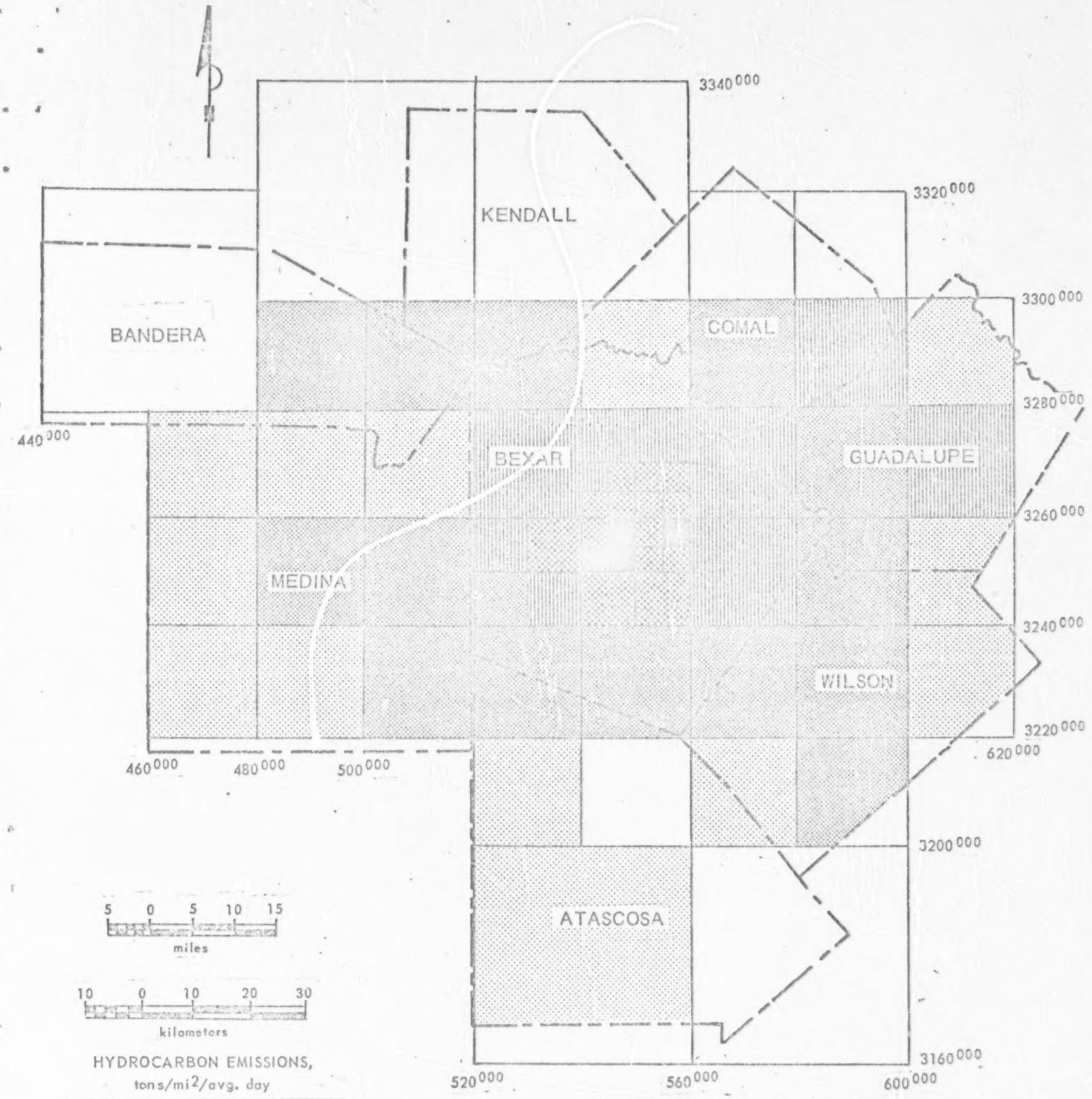

Figure 9. Hydrocarbon emission density map for all sources in San Antonio study area, 1968

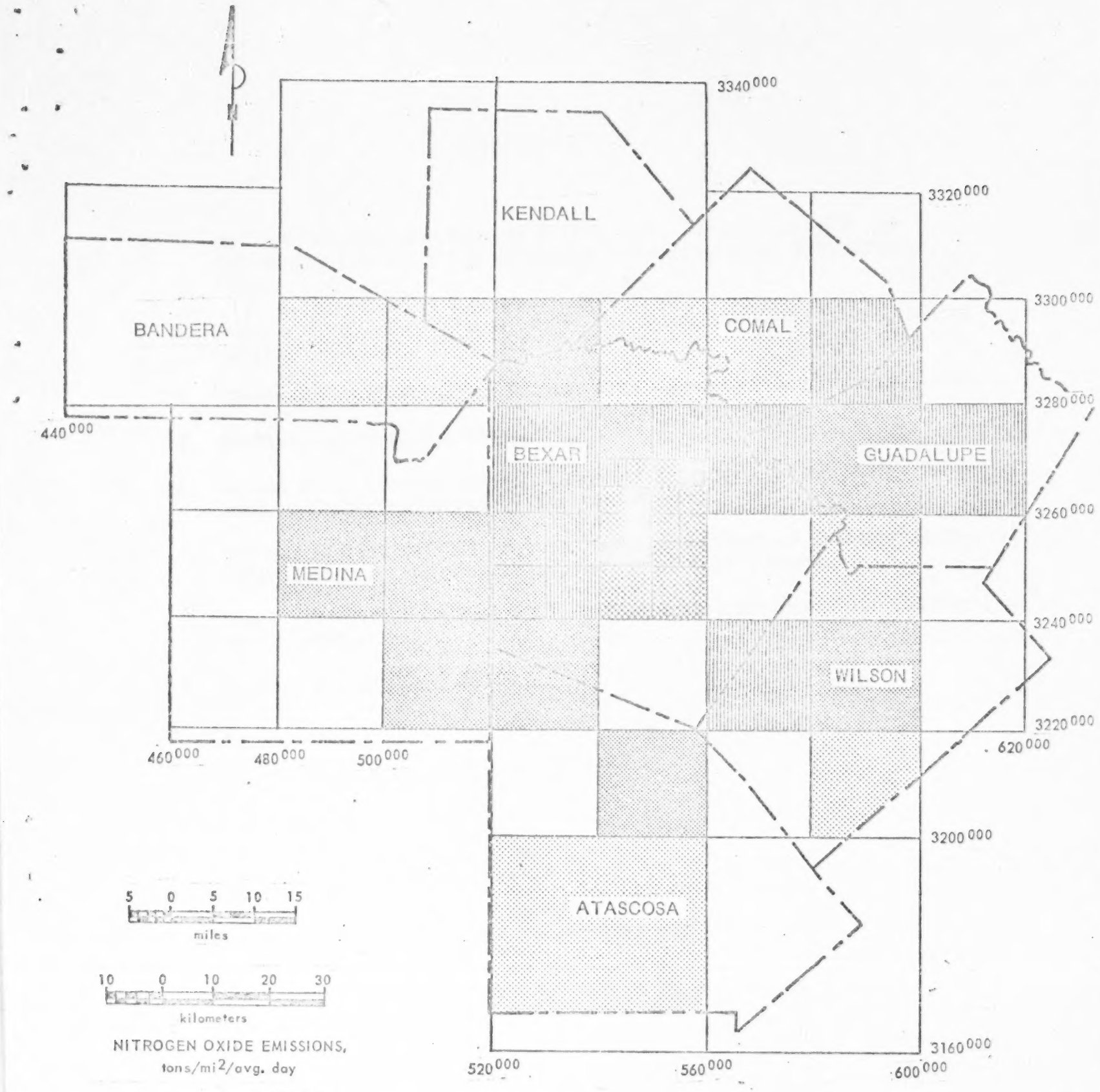

Figure 10. Nitrogen oxide emission density map for all sources in San Antonio study area, 1968.

METHOD FOR CALCULATING SUMMER, WINTER AND ANNUAL

AVERAGE EMISSIONS FOR FUEL CONSUMPTION IN STATIONARY SOURCES

YEARLY AVERAGE (A)

$$A = \frac{\text{Fuel Consumed} \times \text{Emission Factor (E.F.)}}{\text{Days of Operation}}$$

e.g. A plant consumed 100,000 tons of coal in 1967 while operating 365 days. The total degree days for the area was 4,800 and 2,800 for the three winter months. The plant was estimated to use 15 percent of the fuel for space heating and 85 percent for process heating. From this information, the annual average emission for carbon monoxide would be the following:

$$A = \frac{100{,}000 \text{ Tons/year} \times 3 \text{ lbs. CO/Ton coal}}{365 \text{ Days/year} \times 2{,}000 \text{ lb./Ton}}$$

$$A = 0.41 \text{ Ton/Day}$$

WINTER AVERAGE (W)

$$W = \frac{\text{Fuel Consumed} \times \text{E.F.}}{\text{Days of Winter Operation}} \times \frac{\text{Winter Degree Days}}{\text{Total Degree Days}} \times \text{\% Fuel Used for space heating}$$

$$+ \frac{\text{Fuel Consumed} \times \text{E.F.}}{365} \times \text{\% Fuel used for process heating}$$

$$W = \left[\frac{100{,}000 \times 2{,}800}{90 \times 4{,}800} \times 0.15 + \frac{100{,}000}{365} \times 0.85\right] \frac{3}{2{,}000}$$

$$W = 0.49 \text{ Ton/Day}$$

SUMMER AVERAGE (S)

$$S = \frac{\text{Fuel Consumed} \times \text{E.F.}}{\text{Days of Summer Operation}} \times \frac{\text{Summer Degree Days}}{\text{Total Degree Days}} \times \text{\% Fuel Used for space heating}$$

$$+ \frac{\text{Fuel Consumed} \times \text{E.F.}}{365} \times \text{\% Fuel used for process heating}$$

$$S = \left[\frac{100{,}000}{90} \times \frac{0}{4{,}800} \times 0.15 + \frac{100{,}000}{365} \times 0.85\right] \frac{3}{2{,}000}$$

$$S = 0.35 \text{ Ton/Day}$$

REFERENCES

1. Ozolins, Guntis, and Raymond Smith, Rapid Survey Technique for Estimating Community Air Pollution Emissions, DHEW, PHS, October, 1966.

2. Duprey, R. L., Compilation of Air Pollutant Emission Factors, United States, DHEW, PHS. 1968.

3. Population Estimates, San Antonio Area Council of Governments, 1968.

4. Ozolins, op. cit., pp 43-45.

5. Retail Trade Special Report, Census of Business, United States Department of Commerce, Bureau of the Census 1963.

6. Highway Statistics/1967, United States Department of Transportation, Federal Highway Administration, Bureau of Public Roads.

7. County and City Data Book 1967, United States Department of Commerce, April, 1967.

8. Duprey, op. cit., p. 46.